The Bee's Needs

Bees have been buzzing around our planet for almost 100 million years. That's 999,800,000 years before we Homo sapiens showed up on the planetary bio-map. Related to wasps (yellow jackets, hornets, etc.), there are over 20,000 known species worldwide, and are entirely herbivorous, unlike their carnivorous cousins.

I'm sure we have all been lucky enough to spot a bee on a beautiful summer day, humming happily at any given flower (that is of course, if a fear of bees hasn't been implanted in us, something I have observed and find rather tragic – fear of nature by her own children). I myself have spent quite some time trailing beautiful bumblebees across the dandelion-rimmed trails in the temperate forests Washington, stalking the bright orange Patagonian bee through the mountain ranges of the Andes – even tending to them in an organic acacia apiary (bee-farm) under the lip of the Alburni mountains in Southern Italy. Their constant dedication to their tasks at hand, the fascinating mathematical structures of the honeycomb, and of course, the dripping sweetness of fresh honey, has captivated my interest and admiration for humble bee.

Their presence across the world, and their importance as pollinators and providers of honey, has likewise attracted attention and praise throughout recorded history.


Ancient Egyptian Relief of a Bee Hieroglyphic

From dedicated Egyptian hieroglyphics to countless poems (think Aesop's Fables, the Upanishads, Virgil, Shakespeare, E.O. Wilson, Emerson, Goethe, Thoreau, G.B. Shaw, Emily Dickinson, and many more), the complex nature and seemingly perfect social balance of bees has fascinated and inspired us for thousands of years. The bee was revered and played a central role in the mythologies and worship of the ancient Mayans, Greeks, Indians, Minoans, Celtics, and many more. Honey was the mystical 'nectar of the gods', and the bee seen as a goddess and creator of divine mathematical proportions. And not without just cause.

The bee is a majestic being. In simply preparing for this article, I ended up reading over 3 books and 20 articles – not because I needed to present that much information, but because their social structure and biological development is so utterly fascinating I was drawn into it completely. While we think of them as social creatures, in reality, less than 4% of all bees are actually social. The rest are solo fliers, digging nests in undisturbed areas of ground and trees. This small percentage however, contain some of the more commoner ones: sweat bees, carpenter bees, and the lovable bumblebee. It is this smaller percentage of the world's bees that have drawn most scientific research and interest, as their social structure, so unlike ours, continues to inspire and draw the curiosity of all.

We've all heard of the "Queen Bee". Almost 2000 years ago, Pliny the Elder was so amazed at the attention the worker and drone bees would lavish on this bee, that thought it must have been a male (A woman? In charge? No….), and referred to it as a King Bee. We know now that it is a female, and she has a majestic hold over the rest of the colony, though she is not the director; a grander collective good is what governs a bee colony, and remains not entirely understood. Prior to setting up her colony, she mates with up to 20 different males, and stores a lifetime supply of sperm in a special sac called a spermatheca. The male bees, called drones live lazy lives prior to this: begging for food from the female workers, living in dirty conditions, and generally performing no duties until mating time. At the mating time, the new queen meets a gathering of about 20 males, at their sexual prime at about 12 days of age. They have cleaned themselves, in preparation for coitus and present themselves for the queen. Many are unsuccessful in their attempts to mate at speeds up to 20 miles/hr in the air (!) and return to their cells, where they are eventually kicked out of the hive or murdered by all the female worker bees (they have been known to have been killed with the stinger of many of the females, as the soft flesh of the bee doesn't hook and remove the stinger like it does in animal flesh). The successful ones have a short lived victory, as the queen bee flies off quickly after mating, ripping off the penis and viscera in her flight, and leaving the male tumbling to the ground in death.. The hive is obviously a very efficient factory – once your task is over, so is your welcome!

The old monarch, and a good subset of the bees from the colony (roughly 10,000) start house-hunting when the hive is over-crowded. The manner in which this happened was discovered by Martin Lindauer, a renowned scientist, who noticed that the bees had begun returning covered not in pollen, but in soot and dirt. When it's finally too crowded to live comfortably, the scouting bees (roughly 5% of the hive, or a few hundred) will begin searching around for a new home – knotholes of trees, cracked windowsills, etc. Using an intricate step-measurement system, the bee will explore the space for up to half an hour, to determine if the house is suitable for the hive. She then returns to report her findings. Communicating with an incredibly detailed dance and vibration of her body, the bee reports the size and details of the potential location. If her dance is enthusiastic enough (firm selling pitch!), other scout bees will head out and investigate the location. This of course is incredible, as the bee manages to communicate the location and distance as well with this amazing dance – I'll get more into this fascinating aspect in a bit. The fact-checkers return, and if in fact agree that it is a suitable location, begin performing the same dance. Ultimately, dancing scouts that aren't attracting a lot of fact-checkers to their team drop off. The dance with the most dancers win, and the bees soar off as one to start a daughter hive in their new home.

This is in itself fascinating for many reasons, and after investigation and analysis, prompted Thomas Seeley, a biologist at Cornell, and his colleagues to create a set of rules from this social communication and interaction that could greatly benefit humans in their collective reality:

1. The decision making process is broadly diffused among ALL the scouts. Rather than having a small group of bees that make decisions for all the bees, all scouts have equal opportunity to discover a new home and convince the hive of it's worthiness, thus being open to the broadest possible input of knowledge and ideas.
2. Each individual has her own opinion and doesn't have to conform to the pushiest bee. All bees that return and report their findings have their opinions second checked by a non-biased bee. The non-biased bee does not have to agree if they find the home not suitable, and in fact this is how homes are selected, as the bee will return and NOT mimic the same dance if they disagree.
3. "The quorum-sensing method of aggregating the bees' information allows diversity of opinion to thrive, but only long enough to ensure that a decision error is improbable." This means that all opinions are considered and given equal weight, until all the bees come to a coalesced decision – not a compromise, but the best possible outcome as considered by all.

These 3 social rules mean that all bees can make the decision that will be chosen, all options are given equal weight and carefully considered, and the best possible outcome is chosen by all. If only Harper would take a clue!

Once the colony is set up, the worker bees immediately start preparing the famed and beautiful hexagonal honeycomb structure.

Worker Bees preparing Honeycombs

Cells are carefully prepared for the queen, with wax layers for her egg deposits. The queen roams the colony and will select and inspect a cell, using her forelegs to judge size. If it meets her requirements, she deposits an egg. These eggs vary in their diploid and fertilized status – the queen makes a decision of whether or not to fertilize the egg with the sperm she carries, and this determines the sex of the bee. If a male is chosen, the cells are noticeably larger, allowing them to grow into fat, reproductively-purposed larvae.

The food of the hive is provided by the foragers, and this is where we pull our lens of observation back and start to view a larger picture. The foragers leave the colony and begin searching for sources of nectar – flowers. Upon successfully collecting the pollen, they return with a full load to the entrance of the hive, where worker bees collect their harvest. In this exchange is another fascinating aspect of the bee communications – monitoring and control of food intake. If the colony is in need of food when the foragers arrive at the door, they are met eagerly and their harvest isimmediately unloaded. If the colony isn't in need of much food at the moment, the foragers often have to wait at the door for up to a minute, buzzing around for a worker bee to take their load. If this begins to happen, their nervous system notes the anxiety and the bee begins agitatedly bumping into other returning bees, letting them know the harvest isn't greatly needed. When their harvest is taken immediately, a nervous system 'reset' takes place and they know it's alright to go back and collect. There is also an intricate dance that takes place at the door if a great source has been found. The bee will come back and begin excitedly wiggling. Through many years of careful observation, the Austrian biologist Karl Von Frisch (who won a Nobel Prize for his work with bees) discovered that the foragers actually denote direction exactly with their dance, and the frequency of their wiggles indicate the distance of the source! (Check out this incredible YouTube video). Other bees read the message and excitedly fly off to harvest from this more lucrative source. Bees have evolved a linguistic communication system that is incredibly precise, adaptive and flexible, based entirely on the motion of dance. This intricacy and evolution just blows my mind.

Macro Bee Pollen Image - from Nasa

Over a hundred million years, flowers and bees have evolved a brilliant symbiosis. The bee forages at each flower, where pollen clings to the numerous hairs all over their body. When the bee moves on to the next flower, some of the pollen from the first flower is deposited, and so the bee acts as the go-between in the sexual mating of plants. This seemingly simple, yet incredibly glorious relationship between pollinator and pollinated is filled by several other animals, and has been a contributing factor in all the flowers you see (like the flowers you just received for Valentines Day!). While seemingly simple and small, the role of a pollinator is absolutely essential in a healthy ecosystem. Our global plant life depends on this act of feeding and sharing, and without protecting this fragility, the biological health of the planet is greatly endangered.

With increasing urbanization and mono-cropping of agricultural areas, the disappearance of our forests, meadows, grasslands, and biological life make the bees beautiful existence a fragile one. In addition to the loss of habitat Globalization is allowing bee pests and diseases to spread rapidly around the world, wiping out populations internationally. The United Nations Environment Programme (UNEP) released a report calling the decline of populations a global phenomena – see here. The reports tells us that of over 100 crop species providing over 90% of the worlds food, 71 of them are bee-pollinated. Where will the food come from if bees die? I inwardly cringe at the idea of an all factory-produced diet, and hope anyone with half a sense of 'you are what you eat' does as well. "Well, that's alright", you think. "I eat mostly meat". But what are those animals going to eat? Synthetic factory grains? The plight of the honeybee is a dangerous reality that we would do well not to ignore. In addition to their incredible structure that we could learn so much from, they literally provide us with most of our foods. Not to mention our gorgeous flowers.

So what can we do to save the bees? First and foremost is habitat conservation . This is important for so many other reasons beside just the bees. Don't buy the oversized house in the suburbs, decrease your land imprint, and increase the natural, native plant life found on your property. Plant wildflowers around the margin of your property, giving bees more food and brightening up your property as well. Next, alternative agriculture. Again, important for many other reasons. Buy organic and local, and/or grow your own food. Lower purchases of pesticide heavy crops mean less growth (supply and demand), effectively lowering the input of dangerous pesticides and toxic chemicals into our environment. Corporations often spray at pollinating times of the year, killing off these precious and valuable bees as they do their

work for a healthy planet. Every purchase of a trusted organic product saves a bee! (No math behind that one, just a concept ). Finally, buy honey from a good, trusted local farmer. Local bee farms (apiarys) are havens for many bees – places where the farmer does their best to ensure their health and reproduction in large numbers. Supporting these farmers gives them motivation to keep on taking care of their bees. Additionally, the health benefits of local honey are vast – especially if you suffer from seasonal allergies. Local honey often contains low doses of that which you are allergic to, contributing towards your general immunity. Not to mention – it is absolutely delicious. Heaven can be found in a teaspoon of fresh honey. Believe me.

So don't be afraid of the bees. Show 'em some love – they've evolved into incredible managers of our plants and food. If conservation efforts fail, the decline of the bees immediately impacts over 20,000 plant species. And each of those plant species will go on to affect huge networks of our interlinked living web – turning the world into a devastated place. They are an important, non-negotiable linkage in the ecosystem of our planet. As UNEP eloquently states, "Pollination is not just a free service but one that requires investment and stewardship to protect and sustain it."